A gas processing unit (GPU) is a modular piece of equipment that is employed, especially in the Marcellus Shale, to perform a majority of the phase separation of the well stream fluids. A GPU is a step above the typical 3-phase separator for a number of reasons:

1. It is self-contained
   a. GPUs arrive on a skid and are prepared to begin processing once they are tied into the flowline, stock tanks, and sales line.
2. It is more than just a 3-P separator
   a. A GPU includes not only the separator but also a glycol bath and auto choke.
3. GPUs are smart equipment
   a. Many aspects of the GPU allow it to be controlled remotely or shutdown in the event of an emergency.
The Glycol Bath

The glycol bath is the first part of the GPU that the well stream fluid encounters as it exits the flowline. It is comprised of a large tank that contains glycol which is heated with a burner tube to approximately around 100 degrees Fahrenheit. The well stream fluid never comes in direct contact with this glycol, but rather passes through the bath inside of a pipe that winds back and forth to maximize exposure to the heat. The purpose of this feature is to aid in fluid separation (heat decreases oil viscosity) and to prevent the formation of methane hydrates at the next portion of the GPU, the auto choke.

The Auto Choke

The auto choke immediately follows the glycol bath and it is here that the flow of the well stream fluid is controlled. The auto choke can be adjusted by the on-site computer (known as an RTU or remote terminal unit), through a cellular network by an operator or even manually by turning the wheel. The auto choke can be utilized to maintain a constant pressure or rate through the GPU or can close in wells due to an emergency like a stock tank being close to over-filling. The auto choke produces a large pressure drop (possibly from well over 1000 psia down to 100 psia or less depending on the separators design parameters) which in turn cools the well stream fluid; this could lead to the formation of methane hydrates if it were not for the preceding glycol bath.

Three Phase Separator

The three phase separator is the component of the GPU that actually performs phase separation. The separator is primarily a highly engineered empty space that gives gravity time to work and separate the phases by density. Please refer to the generic separator schematic below.
Other notable parts of the three phase separator are the inlet diverter and the mist extractor. The inlet diverter causes a majority of the separation by incurring a sudden shift in the momentum of the fluid allowing a majority of the separation to take place. The mist extractor simply catches any oil mist remaining in the gas and allows it to coalesce into droplets large enough to fall back into the liquid section (it does this by having a large exposed surface area- think steel wool).

Coriolis Meter

The final part of the GPU are two small inline Coriolis meters. Coriolis meters allow the density and rate of a fluid to be measured without having any physical device inside the pipe. How a Coriolis meter works is beyond the scope of this technical description however they do serve an important function. The density of produced water will be known to the operator as well as the density of produced oil; if the density of the water begins to drop it is an indication oil is mixed with the water and something is wrong with the separator, this also works the other way (if the oil begins to get heavier due to water exiting through the oil outlet.

Photo Credit: Luke Spinuzza

Coriolis Meter
Conclusion

The GPU is an excellent piece of equipment for use in any field, but it is particularly well suited to the Marcellus Shale region. Its self-contained design allows it to be put into use once it is set in place and connected to a few different flowlines. Additionally employing one GPU per well allows the operator to exercise greater control over the multi-well pads (up to 10 wells per wellsite) which is typical of the Marcellus Shale play. This allows the operator to adjust the flow or shut-in any individual well without impacting the flow from the other wells on the pad. Finally, it may be necessary to choke back a new well on a pad for other reasons. A new, higher pressure well can halt production from older wells as sales line pressure will be increased to the point where older wells cannot compete - and this can actually reduce total production. By employing a GPU for each well operators can help to combat this detrimental effect.